Marine Environmental Education in the San Juan Islands, Washington

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Abstract
This study illustrates the process of marine environmental education for year-round residents in the San Juan Islands, Washington, by describing and evaluating two marine environmental education projects with contrasting learner groups. One of them is the Forage Fish Project, which educates and involves adult local residents as volunteers in surveying beaches to identify forage fish spawning sites. The other is the Fish Art Project, which used the nearby marine environment as an integrating context for formal education in a 4th, 5th and 6th-grade class in a local school. These programs were evaluated in the information, attitude, and action aspects of environmental education. This study reveals how these programs were planned and implemented, and shows that the learners in both programs were deeply involved in hands-on activities and exposed to the notion of ecosystem. It also shows that these programs have implications for marine protected areas, that they are difficult to sustain because they are small-scale and community-based, and that good use of partnerships contributed to the programs' accomplishments. It provides valuable information regarding what measures are effective and what challenges can be expected in community-based marine environmental education.

Introduction
The term "environmental education" has been defined, interpreted and discussed in various ways (e.g., Palmer and Neal 1994; Braus and Wood 1994; Bogner 1998). However, environmental education's ultimate goal is always to improve and ensure environmental quality. No matter how environmental education is interpreted and broken into analyzable elements, it always encompasses three aspects (1) the information aspect, e.g., improving people's environmental understanding, knowledge, awareness, concepts; (2) the feeling aspect, e.g., enhancing people's environmental sensitivity, values, attitudes, responsibility, concerns, motivation; (3) and the action aspect, e.g., improving people's behavior, skills to solve environmental problems, participation, decision making, etc.

This study investigates the process of two marine environmental education programs in the island community of San Juan County, Washington. In the study I describe how the programs were designed, implemented and received. I then evaluate them in the information-feeling-action framework.

The San Juan Islands are a group of islands, reefs and rocks in northern Puget Sound. The 2000 Puget Sound Update report of Puget Sound Ambient Monitoring Program (Puget Sound Water Quality Action Team [PSAT] 2000) shows that the abundance of many marine species is in decline throughout Puget Sound. Among them are several species of bottomfish. This PSAT document also reports the decline in killer whale *(Orcinus orca)* population that has occurred in the past five years. The trends of forage fish species are either declining or unknown (PSAT, 2000).

Overall, San Juan County residents are environmentally aware. As many of them sensed the decline in fish populations in the inland sea around them, they took action to address the issues. In 1996, the San Juan County Board of Commissioners established a Marine Resources Committee (MRC) to address various issues in the marine environment. The MRC members are appointed by the commissioners and include scientists, politicians, fishermen, business owners and citizens at large. This citizen-based body is charged with coordinating and overseeing marine protection measures across the county. It advises the county commissioners on management and protection of marine resources.

One of the first marine resource problems that the MRC tackled is the perceived decline of the bottomfish population. The term "bottomfish" as used by the MRC refers to five species of rockfish: copper *(Sebastes caurinus),* black *(Sebastes melanops)*, tiger *(Sebastes nigrocinctus)*, quillback *(Sebastes maliger)* and yelloweye *(Sebastes ruberrimus*), as well as lingcod *(Ophiodon elongatus)*, kelp greenling *(Hexagrammos decagrammus)* and cabezon *(Scorpaenichthys marmoratus)* in the San Juans. Based on the MRC's recommendation, the county designated eight voluntary Bottomfish Recovery Zones, where fishermen are advised not to catch bottomfish.

Also on the MRC's agenda is the protection of forage fish spawning habitat. In Puget Sound, the major forage fish are Pacific herring *(Clupea pallasi),* Pacific sand lance *(Ammodytes haxapterus)* and surf smelt *(Hypomesus pretiosus)*. One important means to enhance the abundance and survival of forage fish is to identify beaches where they spawn and protect those beaches from development. To identify forage fish spawning habitat in San Juan County, the Forage Fish Assessment Project was begun in 2001.

These and many other marine conservation initiatives in the San Juans are closely associated with or encompass environmental education efforts. This study focuses on two such marine environmental education programs for the local residents the Fish Art Project and the Forage Fish Project. The Fish Art Project was a trimester-long marine studies program in a 4th, 5th and 6th-grade class at a local elementary school. The Forage Fish Project is a three-year program that engages educated citizens in identifying spawning sites of surf smelt and Pacific sand lance.

Method

This study is largely a "process evaluation," which Patton (1990) defines as an inquiry that aims to elucidate and understand the internal dynamics of how a program operates. He describes process evaluation as focusing "on how something happens rather than on the outcomes or results obtained" (p. 95). Providing a description of the program process, I hope to illuminate the practical operations of the Fish Art Project and the Forage Fish Project and inspire environmental education practices elsewhere. I also report and discuss the outcomes of the marine environmental education programs.

I used qualitative research methods to capture the context in which the programs took place, the interactions among those involved and the nature of the education activities. This research relied on methods such as document analysis, participant-observation and open-ended interviews (Patton 1990; Best and Kahn, 1998; Yin 1994) for information collection.

In the beginning of the study, I conducted preliminary, unstructured interviews with three local marine educators in the San Juans to gain a broad and basic understanding of the spectrum and dynamics of marine environmental education in the area. Among all the marine environmental education programs that these informants mentioned, I chose to study the Fish Art Project and the Forage Fish Project. This is because these two programs have longer educator-learner interactions, more tangible products, better defined learner groups and greater potential for achievement in all three aspects of environmental education. These two programs are more structured than others, and they both target year-round local residents.

Because the Fish Art Project was started and completed before my study began, I was unable to observe the actual implementation of the project. However, in the preliminary interviews, I consulted three of the four local educators who contributed ideas to the design of the program, and I obtained an introductory view of the project. I then conducted in-depth open-ended interviews with two of them. These two informants interacted with the students in several activities during the program implementation stage, so they not only spoke of the program objectives but also described what and how the students learned. I obtained such descriptions also from interviews with three students and their parents. In addition, I reviewed the works the students produced. I also reviewed a brief report and newspaper articles on the Fish Art Project.

Regarding the Forage Fish Project, I interviewed the program's first and second coordinators, and four volunteers who participated in the program since its beginning. The coordinators and volunteers described the project goals and the education components of the Forage Fish Project as they perceive them. They provided information regarding the content of what was taught and learned, how the education progressed and how they felt about it. I also briefly interviewed two people associated with the University of Washington's Friday Harbor Laboratories (FHL), who participated in some activities in the program as technician or technician candidate. They provided their observations regarding the educational work of the Forage Fish Project. In addition, I reviewed internal documents regarding the project's design, grant proposals, web-based articles describing the project and the teaching materials used in the training. I also participated in a field survey and interacted with a first-time volunteer and the project coordinator. Moreover, I communicated with the former and present directors of the environmental organization in which the Forage Fish Project is housed to obtain their understanding of the project.

In analyzing each program, the key issues that were brought up in the interviews were examined and compared. Salient features of the project were discussed. To evaluate a program, I present its achievements in the three aspects of environmental education. The relevant outcomes that are not captured by the three-part environmental education framework are also discussed. Finally, I compare the two programs to identify the lessons learned.

Process Evaluation of the Fish Art Project

Program Design and Objective

Despite the name, the Fish Art Project encompassed a wide range of activities to educate children about the ocean, with art being only one of the media used. Teacher Vic's (pseudonym) intention was to teach his students, in an interesting and educational fashion, about the marine environment and marine life. There seemed to be no explicit intention to enhance the children's attitudes toward nature, the values they place on nature, and their participation in solving environmental problems.

In winter 2001, Vic met with the outreach officers of the Bottomfish Recovery Program, Forage Fish Project and FHL to collaborate on designing this program. The outreach officers were interested in having the class learn about certain species such as bottomfish and forage fish so that the program would complement their duties in their respective organizations.

The four share many ideas about activities for the students to participate in. They designed a trimester-long marine studies program and allowed flexibility in the plan to respond to upcoming opportunities. The outreach persons from the Bottomfish Recovery Program and FHL also participated in some class activities as co-teachers.

Program Implementation

The Fish Art Project took place in the spring of 2001. It involved a number of indoor and outdoor activities. The students went on two boat trips to learn about oceanography and sailing. They monitored a local beach. They visited Padilla Bay National Estuarine Research Reserve, where they learned about the composition of and natural processes in an estuary. They followed a recipe and created an Estuary Soup, adding into a bowl certain amounts of water, salt, seaweed, phytoplankton, zooplankton, etc. They then heated and stirred the mixed ingredients thereby imitating the effects of the sun and the tide. The students drew the recipe and the cooking process onto a mural in their classroom. They also studied plankton in more depth and drew many pictures of the plankton.

In the classroom, the students played a game in which they imitated how things on the beach, such as water, eelgrass, bird, the sun and moon that affect the tide, interact with one another. For example, when the moon brought the tide inshore, various beach organisms had to change their locations. The purpose of this game was to help the students understand the complexity and dynamics of the intertidal zone. They also dissected four bottomfish that a co-teacher bought from Seattle's Pike Place Market. The students closely observed the exterior of the fish and dissected them to examine the inside.

Another game they played was a fish-matching game, which was modified from an activity that a co-teacher formerly taught elsewhere. The students each drew from a hat a bookmark-sized card that had a drawing of a local fish on it. There were two copies of each fish card. There were information sheets posted all over the walls that described each fish's habitat, history, food, etc., and bore the fish's picture. Each student had to find the other student who had gotten the same fish card, and they had to match their fish to the right description on the wall. Thus, the students were paired, and the fish they had on their cards was the one they would go on and study in depth.

Once each pair of students was assigned a fish to study, they had to ask 15 to 40 questions about the fish. Some of the questions became very detailed. Then, they were asked to answer them. Under the teacher's guidance, they read books and searched on the Internet to look for answers. They compiled the answers from the various sources and created their own fact sheets about 11 species of local fish.

Vic made photocopies of sketches of eleven rockfish and forage fish from science books, e.g., *Pacific Fishes of Canada* by J. L. Hart (1973). These pictures were not to scale. The students worked in pairs to draw a to-scale fish based on the pictures that they were given. To enlarge the fish to life size, some students transferred the sketches from fine-grid paper to large-grid paper with many attempts. They held the life-sized fish sketch on the large-grid paper against the window and traced it onto a blank piece of paper. Others, after transferring the smaller sketch of the fish to the large-grid paper, simply erased all the lightly-drawn gridlines to get the to-scale drawing of the fish. Ed described, "I liked drawing the fish. It was really challenging [because] it was like you had this grid, and you had to look really closely what's in this square. Then you had to draw really lightly, on the bigger paper. You had to draw it bigger. You had to draw what you see except bigger. That's really hard, but it was really fun." He said they spent a lot of time on this "because there were tons

of squares, even inside the body! So we had to keep doing those squares to get it right."
The students then looked at many photographs to observe the real colors of the fish. They tried mixing watercolors many times to come up with the perfect colors to paint the fish. This activity required much attention to detail. Student Al (pseudonym) described the process as follows:

"We did a lot of looking... And me and my partner, we painted a yelloweye rockfish. So we spent a lot of time mixing the perfect colors, and finding what worked, and we spent a lot of time on fish, just painting...We would have to notice like this area behind the gills is more red-ish than the others. Right behind the fins it's a lot white-ish, and you had to find the perfect color for that. And we spent a lot of time looking at details and when we were drawing the scales, we had to find different pictures and look exactly how the scale was, how big it was, what kind of shape it was. So was it really long? And how evenly spaced? We spent a lot of attention to details."

Student Sam's (pseudonym) mother agreed, "Yeah, and some of them did a lot of arguing about just what color it should be!"

These activities helped create two group products: *Fish Facts!* and the Salish Sea Soul. *Fish Facts!* is a small book which includes a brief description of the Fish Art Project and 11 fact sheets of local fish species, featuring the watercolor drawings that the students accomplished. The book is on display at the Whale Museum on San Juan Island and at a mini aquarium at the Port of Friday Harbor. The Salish Sea Soul is part of a state-wide public art project, the Soul Salmon 2001, to raise public awareness of salmon recovery. A Soul Salmon is an eight-foot long soul salmon sculpture made of fiberglass to be decorated by artists and displayed in public. Vic's class was given one to decorate. The original life-sized fish drawings and plankton drawings from the Estuary Soup mural were glued onto the sculpture, which was then named the Salish Sea Soul and displayed in the Whale Museum in Friday Harbor (Photos 1-3).

The students also produced individual works, one of which is a poem written by Ed regarding the fish he studied, the starry flounder.

Flounders

I lie on my tummy
and wait for
something yummy to fall,
anything at all.
I'm so opportunistic,
I'll even eat lipstick.
I'll eat friend or foe
Even though
some are poisonous.
That one looks yummy.
I think I'll try.
Poisonous! Goodbye.

Environmental Education Outcomes

• The information aspect (awareness, knowledge, understanding, etc.)
The achievement of the Fish Art Project in the information aspect of environmental education, which this program intended to enhance, is high. For example, when Sam was interviewed six months after the program completion, he retained knowledge of many specifics of Pacific herring, which he studied and drew. "[Herring are] pretty important because a lot of things eat them, like salmon and whales and seals. They need places where eelgrasses grow to lay their eggs . And they just go in a group so it would be safer, to be in a group; whereas you re small and you re eaten by a lot of bigger fish."

Although the students did not have a clear concept of some terms they used (for example, Sam used words such as "habitat" and "ecosystem," but when I asked him to define "habitat," he was only able to provide a description of herring's habitat), the overall depth and accuracy of the factual knowledge of fish that the students acquired and retained were exceptional. It is not unusual for children at this age to find abstract concepts difficult to grasp.

Salish Sea "Soul Salmon" on display at the Whale Museum in Friday Harbor, Washington.

Also worth mentioning is the students' awareness of human-ocean interaction. Fishing and pollution are the two major human impacts on the marine environment that the students spoke of. For example, without using the word "bycatch," Al noted, "One other thing that we learned is how some people they accidentally catch rockfish. If people brought them up too quickly, their stomach would come out of their mouths. And how a lot of people would just throw them away just because that happened. Disgusting things like that."

Sam said he was aware of some fish in trouble and explained the troubles to be, "People fish too much. They catch more than they need. ... And apparently pollution. And the food that [some endangered fish] eat, that population is also going down."

• The feeling aspect (values, attitudes, concern, motivation, etc.)
When asked whether the Fish Art Project made them care about the ocean more, the students did not have a concerted answer. Al paused and said, "Well, I always care about the ocean." Sam hesitated and replied, "I think I do because I ve learned more about it [the ocean]. It seemed so much more interesting, exciting, fun."

Nonetheless, through the Fish Art Project, the three students all became highly interested in fish, and they reported that all their classmates too had the same affection for fish. Al described, "We really liked studying fish. It's kind of funny [because] there was this flounder, and everybody really liked the flounder just because how weird it was. We did really well in our drawings. And wolf-eel, you know. We liked that one a lot. So weird lookin ! Yeah, we liked fish a lot. We were kind of into it." Ed and Sam both gave similar examples of how the entire class became very fond of fish.

• The action aspect (behavior, skills, participation, decision making, etc.)
The students did not self-report any drastic changes in their action resulting from the Fish Art Project. However, Al said he would be more careful when he went to the beach to play with crabs. He would put the crabs and other animals back where he found them. Sam would avoid littering on beaches and would pick up trash he saw. He became very aware of litter on the beach, and this is probably a result of the beach monitoring activity. Other than that, the students did not think that they, as children, had much to do.

But if they had the power to change adults, Sam would "have them NOT throw their beer cans off the side of the ship because there's a LOT of beer cans on the beach. I think they got thrown off the ship." He and Al both mentioned that people should prevent oil spills, but this is probably not a direct outcome of the Fish Art Project but of an activity in which they learned about oil spills prior to the Fish Art Project.

Al, Sam and Ed could not think of measures which people could take to protect marine species and environment other than keeping the oceans cleaner. One of the co-teachers mentioned that the students visited the Bottomfish Recovery Zones on the boat trip, so I gave them a hint and asked them whether they were aware of any protected areas in the sea.

Al was the only one who recounted, "I do know we went to an area, and it's just a teeny teeny little island. I don t know the name. I think it's called Yellow Island. It was like a protected area. You have to keep on the trail. You can t take any stones with us. Or pebbles. We were on this [island] and looked at this endangered species on it. There's this one called like rattlesnake plant. We learned about that and that the waters around it is also protected. There were some seals that were on the rocks on it, and we had to be quiet when we were going by. They were really close. We saw a bunch of otters."

Yellow Island's surrounding marine area to 300 yards offshore is a marine preserve managed by Washington Department of Fish and Wildlife and FHL (Murray 1998). The land area of the island is also a protected area owned by the Nature Conservancy. Al later recalled passing by one of the Bottomfish Recovery Zones and the teacher saying that people should not catch bottomfish there.

• Features outside the environmental education framework
Two of the parents and a co-teacher noted that the required subjects in elementary school curriculum, such as math, science, language arts, etc., were integrated in the Fish Art Project. The learners rarely noticed that they were in a math session or that they were developing communication skills and so on, but many of Washington State's Essential Academic Learning Requirements were met in the process of this program. A recent nation-wide study shows that, when the required subjects are taught in a program with an environmental topic and are integrated in the context of the environment, students perform better in disciplinary standardized tests than those in a program in which the boundaries between disciplines are clear (Lieberman and Hoody 1998). The research also indicates that students in a program that uses the environment as an integrating context have more developed thinking skills and better interpersonal abilities.

Another feature of the Fish Art Project is that it provided the students a sense of pride because the group works they produced are on display in public and many people can see their works. Al, Ed and Sam all said they were proud of their products.

Process Evaluation of the Forage Fish Project

Program Design and Objective

The purpose of the Forage Fish Project is two-fold: science and education. The scientific purpose is to generate knowledge of forage fish spawning locations. This purpose is explicit in the program's grant proposals and a description prepared by Friends of the San Juans (Friends), the organization that manages the program, on its website. The purpose of educating the public is more implicit and has not been articulated in written form. Nevertheless, it is perceived by both the former and current directors of Friends, both the first and second project coordinators, and all four volunteers that I interviewed. The former director explained that the Forage Fish Project used to be a component of Friends' Shoreline Stewardship Program, which has an explicit goal of enhancing local citizens' understanding and appreciation of the coastal environment by engaging them in shoreline monitoring. He noted that when the Forage Fish Project expanded and became independent of the Shoreline Stewardship Program, the goal of educating the public was passed on to, and remains embedded in, the Forage Fish Project.

The main educational objective of the Forage Fish Project is to build the skills in the citizen volunteers that enable them to adequately collect sand and gravel samples from the beaches and in so doing take action to help protect forage fish.

The MRC, Friends, a forage fish scientist from Washington Department of Fish and Wildlife (WDFW) and a local environmental consultant planned this program collaboratively.

Program Implementation

The education process of the Forage Fish Project started in March 2001 with a formal in-lab training session at FHL for the volunteers. Approximately 12 volunteers participated. Also present were the first project coordinator and the director of Friends, the WDFW scientist and local environmental consultant, as well as a project technician candidate. In this training session, the volunteers received a copy of the Field Manual. The WDFW scientist gave a briefing of the project and training. The volunteers saw slides and were introduced to the basics of forage fish. They looked at the forage fish eggs under dissecting microscopes and noticed the slight differences among them. This gave the volunteers an idea of what they would be looking for in the field, because sand lance and surf smelt eggs are difficult to distinguish from sand particles with the naked eye. Participants were told how to sample beach sediment and were given a chance to practice winnowing the sediment sample. In addition to learning what fieldwork they would do as volunteers, they were also shown the further condensing of the sample that a lab technician would do. This enabled the volunteers to understand the full scope of the project and know what would happen to the samples after they are collected.

On the following day, the group went to the shore and practiced the sampling procedures under the WDFW scientist's supervision. Volunteer Sid (pseudonym) described: "[The WDFW scientist] did a lot of explaining what he was looking for, habitat-wise. What kind of an area you should go ahead and collect samples from. What kind of area you would avoid. And he did a lot of demonstrating. And he had people step forward to try the processes. ... And we did winnowing down to really try to find these eggs in several samples...Everybody had an opportunity to do everything, to, when we were standing on the beach, to say where you thought we should try to take the samples." This exercise concluded the formal training.

In the weeks that followed, volunteers in small groups, led by the WDFW scientist and the project staff, went to the major islands and sampled beaches. A few weeks later, the project staff and volunteers conducted beach sampling without the WDFW scientist's supervision.

In November, the project coordinator organized another training session on Orcas Island for new volunteers. Volunteers Gary and Deb (pseudonyms) participated in both the March training at FHL and the November training on Orcas Island. They remarked that the latter was less rigorous in structure and less rich in content than the former.

There was also an occasion when a volunteer without prior training in the lab participated in a sampling trip and learned about forage fish, their habitat and the sampling techniques all in the field.

A former project technician noted that, when he and the project coordinator conducted the sampling with the volunteers, their casual conversation was often around marine environmental topics. He believes that the volunteers continued to be educated after the formal training. However, Deb did not feel that the education was furthered once she acquired the information and skills from the training session and became skilled at the sampling procedures.

The fieldwork phase of the Forage Fish Project was one year old by the time this study was concluded. Samples examined have not yielded much evidence of spawning.

Environmental Education Outcomes

• The information aspect (awareness, knowledge, understanding, etc.)
The volunteers in the Forage Fish Project acquired knowledge regarding forage fish: their habitat features, their life history and behavior, their pivotal role in the ecosystem, and the fact that there is existing law that prohibits development on identified spawning sites.

Volunteers Sid and Sue (pseudonym) said, "We learned [about] the environment, the fish, our island and the people," as well as "how to accomplish the tasks [sampling] and what the purpose of the project was." Gary and Deb agree and think that the Forage Fish Project provided an adequate depth of teaching about the forage fish.

Some implementers of this program speculate that the program has extended educational effects because the volunteers would talk to their friends, neighbors and families about the program and spread the knowledge about forage fish protection to the larger community. Gary and Deb commented that they told their friends about forage fish as much as they could but only to the extent that their friends would listen. Sid and Sue found that most of their friends were not interested in this topic and they have limited effect of spreading the word.

• The feeling aspect (values, attitudes, concern, motivation, etc.)
The volunteers became more sensitive about the environment and more concerned about preserving the critical habitat for forage fish. Gary said, "I know when I take a walk out on the beach, I m thinking now about what might be there. When I see eelgrass beds or if I hear about somebody wanting a permit to put up a dock, I think, 'Hmm, I wonder what's in this area.' It's really made me very much more aware."

The volunteers I interviewed were all participants in the Shoreline Stewardship Program prior to their involvement in the Forage Fish Project. The participation in the former program probably suggests that they already highly valued the natural marine environment before the Forage Fish Project started. Therefore, the Forage Fish Project can help maintain their positive attitudes toward the marine environment and the preservation thereof but has little potential in greatly enhancing their attitudes.

• The action aspect (behavior, skills, participation, decision making, etc.)
The Forage Fish Project volunteers developed the skills to sample beach sediment for examination of fish egg presence. The time and duration of the sampling work varies according to daylight and tide, but it can begin at dawn and last for hours in cold and rainy weather. The time and energy that the volunteers devoted to the project manifest their dedication to the conservation of the natural environment.

The volunteers' sampling skills seem to have improved over time because the first project coordinator was concerned that volunteer samplers slowed down the sampling process but the second coordinator thought the volunteer's involvement was very helpful.

• Features outside the environmental education framework
Adult learning theories state that adults come to a learning environment with pre-established but varied motives, which are closely related to their life experience (Knowles 1990). This is demonstrated in the Forage Fish Project. Gary and Deb entered the program with a desire to learn. To them, learning is the most important thing they want to get from their participation in the Forage Fish Project. After having acquired the basic knowledge and skills for sampling, when they realized they were not learning much from the actual work of collecting samples, their interest in this program decreased. On the contrary, Sid and Sue's goal was "to be involved in something that supported [their] strong environmental beliefs and commitment." To them, "this goal is being realized, and the learning is a valuable addition." They expressed a much higher interest in conducting the sampling work in the field than Gary and Deb. Sid and Sue enjoyed being on the beach and applying what they have learned to an action that helps protect a component of the ecosystem. They think the best part of their participation in this program is being outside and doing the fieldwork.

Discussion

A juxtaposition of the Fish Art Project and the Forage Fish Project offers some valuable lessons on local-level marine environmental education programs.

First, learners enjoy hands-on participation, whatever the age. Learners in both programs gained familiarity with the marine resources through being involved in tangible activities. They dirtied their hands and had fun. They were not passive information-receivers. They actively dealt with one or more components of natural marine environment. Such involvement, especially if interesting for the learners, has great potential to result in achievements in all three aspects of environmental education.

Second, both programs exposed the learners to the notion of ecosystem. The informational content of the program was not limited to "superstar" species that routinely attract media attention. The learners learned about the crucial roles that forage fish and various natural habitats play in the ecosystem. Moreover, both programs have implications for the management of marine protected area (MPA). In the Fish Art Project, the learners built understanding of the species under protection in the local marine reserves. In the Forage Fish Project, the learners help identify places that may become protected intertidal areas. These are good ways to strengthen local support for MPAs.

Nevertheless, these community-scale, locally developed programs have limited funding and staff, and are difficult to sustain. Both programs suffered from drastic personnel change. But they both benefited much from partnerships among various organizations that share a common goal. Neither of these programs would be possible without several local groups getting together and sharing the resources they had.

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